

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Electric Power Transmission System

We, WESTINGHOUSE ELECTRIC CORPORATION, a Corporation organised and existing under the laws of the Commonwealth of Pennsylvania, United States of America, of
5 Three Gateway Center, P.O. Box 2278, Pittsburgh 30, Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be
10 performed, to be particularly described in and by the following statement:—

This invention relates, generally, to the transmission of electric power and, more particularly, to enclosed conductors for transmitting high voltage electric power.

15 A pressurized gas-insulated enclosed high voltage conductor assembly which is contemplated for use in electric power transmission systems, comprises a cylindrical conductor
20 which is held in the center of a cylindrical pipe by generally disc-shaped insulators surrounding the conductor at spaced intervals. A high dielectric gas, such as sulfur hexafluoride, SF₆, at a suitable pressure provides
25 main insulation and the insulators provide mechanical support for the conductor as well as insulation.

Many tests made on the foregoing system have shown that synthetic resins are among
30 the best materials for the insulators. However, irregularities at the joint between the conductor and an insulator result in corona and breakdown of the insulation. Also, minute projections on the external surface of the
35 conductor can cause corona and breakdown at high voltages.

Accordingly, the principal object of this invention is to provide a smooth joint between
40 a conductor and each insulator which surrounds and supports the conductor, thereby to improve the breakdown characteristics of the conductor.

With this object in view the present invention resides in an electric power transmission

assembly, comprising a cylindrical pipe, a
45 cylindrical conductor disposed inside the pipe, a generally disc-shaped insulator surrounding the conductor to support it in the pipe, and a coating of dielectric material covering the
50 joint between the insulator and the conductor.

It is desirable that the coating be flexible enough to withstand some bending during
assembly of the conductor and insulators in an enclosing pipe or tube and elastic enough to
55 permit thermal expansion of the conductor.

The invention will become more readily apparent from the following detailed description of a preferred embodiment thereof, illustrated by way of example in the accompanying
60 drawing in which:

Figure 1 is an isometric view, partly in section, of an enclosed conductor and insulator embodying features of the invention;

Fig. 2 is an enlarged view, in section, of a portion of the conductor and insulator showing
65 irregularities at the joint between the conductor and the insulator before being coated with a dielectric material;

Fig. 3 is a view, similar to Fig. 2, after a coating of dielectric material has been applied
70 to the conductor and the insulator, and

Fig. 4 is a view of curves showing results of tests of the invention.

Referring to the drawing, and particularly to Fig. 1, the electric power transmission
75 assembly shown therein comprises a cylindrical metal pipe 11, a cylindrical conductor 12 disposed inside the pipe 11 and a plurality of generally disc-shaped insulators 13 (only one of which is shown) surrounding the conductor and spaced along the conductor at
80 intervals to support it inside the pipe 11. The insulators are preferably composed of a synthetic resin, but other suitable materials may be utilized if desired. Each insulator 13 may
85 be cast around the conductor 12.

As shown in Fig. 2, imperfections or irregularities 14 and 15 may occur at the joint

[Price 4s. 6d.]

between the insulator and the conductor. These can cause corona and breakdown of the insulation at high voltages, for example 345 KV. and higher. Also, minute projections on the outer surface of the conductor 12 can cause corona along the conductor.

In order to overcome the problem of corona, a continuous coating of plastics material 16 is applied to the insulator 13 and the conductor 12 to provide an unbroken surface on the insulator and the conductor as shown in Fig. 3. Thus, a smooth joint is provided between the insulator and the conductor and a smooth surface is provided on the conductor which will improve its breakdown characteristics.

For best results, the coating material should have a dielectric constant similar to that of the insulator and should be flexible enough to withstand some bending during assembly of the conductor and the insulators in the pipe 11. Also, the material should be elastic enough to permit thermal expansion of the conductor.

A suitable material is epoxy resin containing hydrated alumina, known by the trade name "Limitrak". A composition of "Limitrak" which is suitable for the purposes of the present invention consists essentially of (A) from 4% to 36% by volume of at least one resinous polymeric epoxide, (B) from 4% to 36% by volume of a polyamide derived by reacting diethylene triamine with linolenic acid, (C) from 2% to 48% by volume of finely divided aluminum oxide trihydrate, and (D) the balance solvent.

A specific example of such a composition is

	Percent by weight
Part I:	
40 Polymeric epoxide	33.3
Polyamide resin	33.3
Aluminum oxide trihydrate	33.3
Part II:	
45 Xylene	80
Ethylene glycol monoethyl ether	20

The composition is prepared by admixing equal parts by weight of Part I and Part II.

Other suitable materials are acrylic resin, lacquer and polyethylene. The coating can be applied in any convenient way, as by brushing, spraying or dipping, so long as a smooth surface is produced.

"Limitrak" is particularly suitable for the coating material because it does not leave a carbon trail through the insulation after it is once broken down or punctured by a spark-

over. Other materials, such as polyethylene, leave a trail of carbon along the breakdown path, thereby eliminating the advantages of the insulating coating. Therefore, any suitable plastic is satisfactory for this application until it has broken down, but "Limitrak" has the advantage of being just as effective after a breakdown as before.

A series of tests on various methods of eliminating the low breakdown voltage caused by rough surfaces on castings have shown that coating a surface in the manner hereinbefore described improved the breakdown characteristics to within 10 to 20% of that for conductors having polished surfaces. The curves in Fig. 4 show the results of tests made on an uncoated casting, a coated casting and a polished brass conductor. Therefore, the invention helps to overcome the problem of corona on enclosed high voltage conductors.

WHAT WE CLAIM IS:—

1. An electric power transmission assembly, comprising a cylindrical pipe, a cylindrical conductor disposed inside the pipe, a generally disc-shaped insulator surrounding the conductor to support it in the pipe, and a coating of dielectric material covering the joint between the insulator and the conductor.

2. An assembly as claimed in claim 1, wherein said dielectric material is of the non-tracking type.

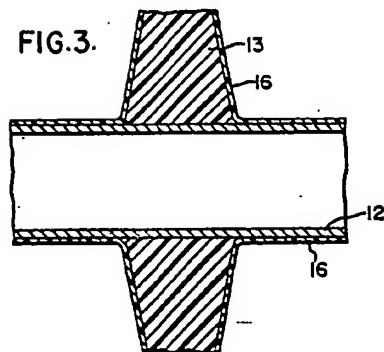
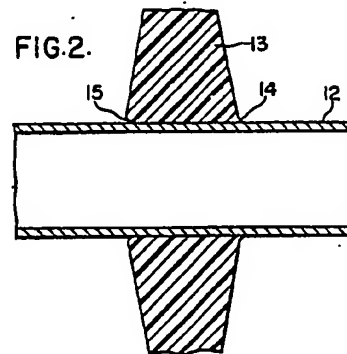
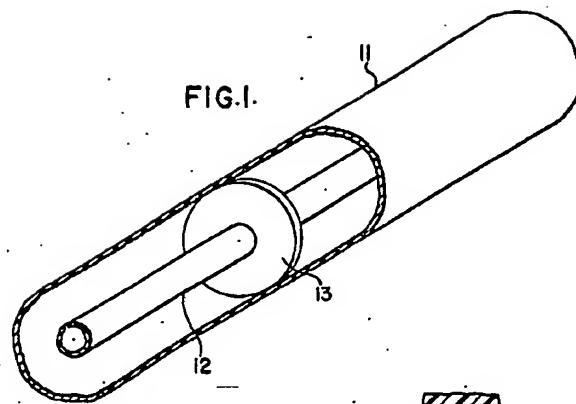
3. An assembly as claimed in claim 1 or 2, wherein the insulator and the conductor are covered with a continuous coating of said dielectric material which also covers said joint to provide an unbroken surface on the insulator and the conductor.

4. An assembly as claimed in claim 1, 2 or 3, wherein said dielectric material and said insulator have substantially the same dielectric constant.

5. An assembly as claimed in claim 4, wherein said insulator consists of synthetic resin and dielectric material is a resinous material.

6. An electric power transmission assembly, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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2 SHEETS *This drawing is a reproduction of
the Original on a reduced scale
Sheets 1 & 2*

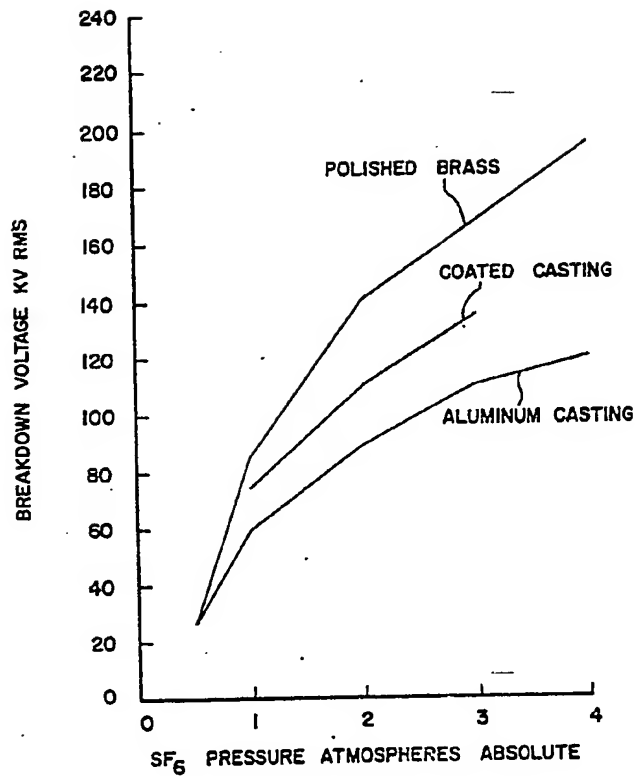
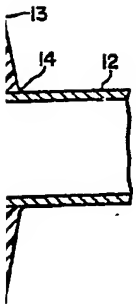


FIG. 4.

